Small Business Innovation Research/Small Business Tech Transfer

Low Power Universal Direct Conversion Transmit and Receive (UTR) RF Module for Software Defined Radios, Phase I

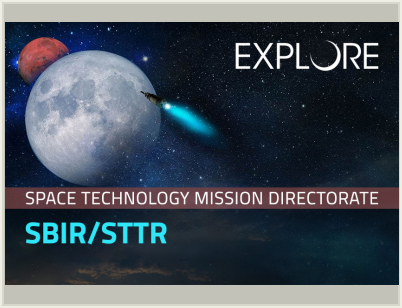
Completed Technology Project (2008 - 2008)

Project Introduction

Conventional software defined radio (SDR) backend signal processors are limited by apriori system definitions and respectively chosen RF hardware. Ideally, the RF sections would be as flexible as the software backends, accommodating widely differing bands and modulation long after fabrication and mission launch; conventional RF tuners limit SDR space mission reconfigurability. The innovation provides a post-launch universal direct RF transmit and receive modulator/demodulator module (UTR) One UTR can replace band specific RF devices otherwise needed for future missions. UTR's modular open architecture is as "reconfigurable" as its complementary digital SDR baseband processing (ADC/DAC's, FPGA's, DSP's). The UTR facilitates communications, radar, narrow (bps) to ultrawideband (GHz) modulation, center frequencies scalable >100 GHz, herein UHF to Ka band. No DC power required for receive mode; novel wideband digital "DAC-less" direct to RF BPSK/QPSK modulation and power amplification is possible. Rugged, radiation hard, reliable due to low active component count and mainstream manufacturing techniques (GaAs MMIC based). Enhanced performance and size leveraged via left handed metamaterials, MEM's switches, GaN and tunable ferroelectrics. Phase 1 UTR simulations, analysis and manufacturing preparation is followed by phase 2 UTR module fabrication (deliverable) and subsystem performance demonstration. TRL 5 expected at phase 2 completion.

Anticipated Benefits

Potential NASA Commercial Applications: A family of commercial products will evolve from this SBIR R&D technology: Reconfigurable UTR RF modules capable of reconfigurable software defined radios spanning UHF to 35 GHz. While the first focus of these products is for NASA and other agencies requiring satellite electronics, the unique wideband RF capabilities directly address the contemporary wireless infrastructure serving multiple bands (WCDMA, GSM/EDGE, CDMA2000, WiMax, WiFi, etc). Wideband operation and low power are ideal for cognitive and mobile adaptive ad hoc networked (MANET) communications and UWB (802.16) based communications systems. The proposed research will support many non-NASA commercial space applications. These range from commercial satellites (Space Systems Loral and Boeing platforms) to U.S. Department of Defense satellites (TSAT, next GPS block, Air Force ANGELS, etc.). In addition to satellites, DoD launch vehicles such as QuickReach (from AirLaunch LLC) will gain from the resulting product. Another existing and now growing market for this technology is the electronic warfare (EW) and electronic attack (EA) marketplace, C4ISR applications focused primarily on DOD software defined radios (eg JTRS, AMF, etc), Homeland Defense initiatives. UWB micropower channel sounding and solid object "xray vision" including sense through wall Army CERDEC activities; and medical noninvasive imaging are also possible applications.



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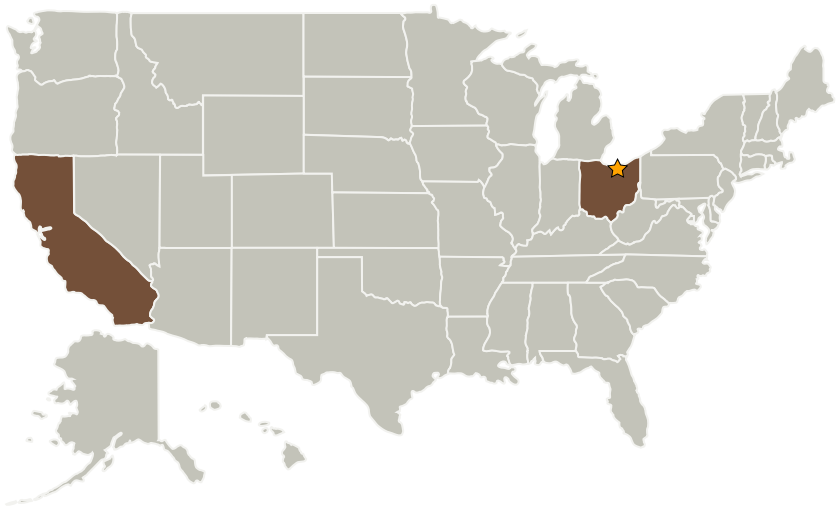
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
Space Micro, Inc.	Supporting Organization	Industry	San Diego, California

Primary U.S. Work Locations	
California	Ohio

Project Transitions

February 2008: Project Start

August 2008: Closed out

Closeout Summary: Low Power Universal Direct Conversion Transmit and Receive (UTR) RF Module for Software Defined Radios, Phase I Project Image

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

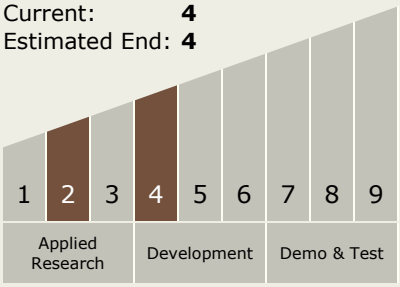
Carlos Torrez

Principal Investigators:

Dave J Strobel
David Strobel

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



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Technology Areas

Primary:

- TX10 Autonomous Systems
  - TX10.1 Situational and Self Awareness
    - TX10.1.1 Sensing and Perception for Autonomous Systems